PSC Overview Series . . .
Environmental Impacts of Electric Transmission Lines

This overview describes many potential environmental and social effects of electric transmission line construction. It can serve as a background information aid for landowners, local officials, and other citizens who expect a new or rebuilt transmission project in their area. The impacts described here are the basic impacts analyzed by PSC staff when a utility applies for permission to build. In a more general way, analyses of these impacts are also used in developing Wisconsin's long-range electric planning.

Introduction

This Overview explains the environmental impacts of electric power line projects. The first part of the Overview provides a general summary of impacts.

The second part of the Overview is an A to Z of specific environmental impacts:

- Aesthetics
- Agriculture
- Airports and Airstrips
- Cultural Concerns
- Endangered/Threatened Species
- Forests
- Historic Sites
- Property Values
- River Crossings
- Safety
- Stray Voltage
- Wetlands

The Public Service Commission of Wisconsin (PSC) regulates power line construction. The PSC's goals are to minimize costs for electric bill payers, to ensure a safe and reliable electricity supply for Wisconsin, and to limit environmental and social impacts. This Overview explains the basis for the PSC's environmental analyses of utility-proposed electric transmission lines.

Major Issues

Measurement of affected areas

The measurements of affected areas depend on the type of land the line crosses and how the line would affect that land. Common measurements include acreage, miles, and number of poles.

In woodlands where trees must be cleared from the right-of-way (ROW), acreage is a better measure of impact than miles. When crossing land where ROW clearing is not the primary impact, mileage may be a better measure of impact. Poles in the middle of a farm field may be the greatest impact in an agricultural area. In this case, the number of poles in a field may be a good measure of impact.

Quality of the environment

Generally, the greater the quality of the existing environment, the more significant the impact. Quality depends on several factors:

- The degree of prior disturbance.

If a natural area, how close is it to its pre-settlement condition? Have the wetlands been drained, ditched, or damaged by suburban development? Have the woods been clear-cut, logged selectively or grayed? Has the area been developed for agricultural, residential, commercial, or industrial use? To what extent?

- The uniqueness of the resource.

Is the resource uncommon in the region or state? Does the resource possess a feature that makes it unique? Does the resource play a special role in its surroundings?

- The threat of future disturbance.

Will surrounding land uses affect the quality of the resource over time? How is the resource valued by those who own or manage it?

Potential types of impact

Long-term impacts exist as long as the line is in place. Temporary impacts occur only during construction or during ROW maintenance. Table 1 summarizes types of impacts.

Table 1 Types of impacts

Type of Impact	Example	Length of Time
Construction	Farm crop loss	Short term
Operation	EMF	Long term
Creation and maintenance of a ROW	Brush and tree trimming or removal	Short and long term
Physical presence of poles and wires	Interference with tilling on farmland	Long term

Degree of impact

Environmental features such as soil type or topography and site characteristics such as existing or future land use can affect the degree of impact. The characteristics of a proposed power line, such as voltage and length, may also affect the degree of impact.

For example, a high voltage line through hilly or mountainous topography would likely have more and greater impacts than a low voltage line crossing flat open pasture land.

Techniques for reducing impacts

It may be possible to lessen, or "mitigate," environmental effects in construction and design. The PSC requires these techniques when applicable. Some common requirements are shown in Tables 2, and 3.

Many techniques for mitigating construction impacts have become standard utility practice. Mitigation opportunities can also be developed throughout the design process.

Table 2 Impact mitigation in the construction process

Impact	Mitigation Opportunity
Soil compaction and disruption of water movement in wetlands.	Allow construction only in winter months when ground is frozen.
Soil erosion on steep slopes and stream terraces.	Use erosion control methods recommended by the Wisconsin Department of Natural Resources (DNR).

Table 3 Impact mitigation throughout project design

Design Step	Mitigation Opportunity
Routing	Share corridors to minimize ROW needed; cross to other side of road to minimize tree trimming.
Pole placement	Place poles directly adjacent to highway ROW or shift their placement to avoid an archeological site.
Choice of structure type	Use taller structures to get a longer span across a river.
ROW maintenance	Plant shrubs and low-growing trees on the ROW in residential areas to minimize the visual impact.

Corridor sharing, replacing existing lines, and placing lines underground may reduce some impacts. However, the success of these methods varies according to the specific project.

Advantages and disadvantages of corridor sharing

Corridor-sharing is possible when the ROW of a transmission line is adjacent to, overlaps, or is within the ROW of roads, railroads, gas pipelines, or other power lines.

In addition, a power line can share a ROW with an existing line by placing both circuits on one new structure (and removing the existing structure). This is called double circuiting.

Sharing corridors with existing facilities minimizes impacts by:

- Reducing the amount of new ROW needed.
- Concentrating linear land uses and reducing the number of new corridors.
- Creating an incremental, rather than new, impact.

However, there are a few instances where corridor sharing may increase impacts. See Table 4.

Table 4 Potential drawbacks of corridor sharing

Corridor Shared	Potential Drawbacks
Railroad	Access roads may be needed if the railroad goes for long distances without crossing roadways.
Gas pipelines	Pipeline ROWs tend to be narrow and often run cross-country. This may require access roads and more ROW.
Town and county roads	In some areas the branches and leaves of large trees form a canopy over the road. Clearing these trees would cause aesthetic impacts.
Existing power lines	Parallel power lines in farmland can create a significant impact due to problems of cultivating around structures. Taller poles used for double circuiting may create a hazard if located in a flyway or other area heavily used by birds.

Corridor sharing may require changes to the existing facilities. Communication circuits for railroads may need to be placed underground. Gas pipelines may need extra protection. These are relatively minor changes. Poles located on, rather than just off, highway ROW are moved at the ratepayers' expense if the highway is expanded.

Advantages and disadvantages of replacing or upgrading existing lines

It may be possible to replace or double-circuit an existing line with a new power line rather than building a new line. If the new line is the same size or slightly larger than the existing line, environmental advantages may include:

- Little or no additional ROW clearing, especially if the new line can be placed in the center of the existing power line ROW.
- Land use patterns may have adapted to the existing ROW.
- Possible reduction of EMF. (New structure designs that place line conductors closer together result in lower magnetic fields.)

However, using an existing line's ROW may not be the best solution when:

- The existing ROW is in a poor location.
- New residential areas have been built around the existing line.
- Customer use has grown more in other areas, so using the existing ROW reduces the efficiency of electric transmission and increases costs.
- Wider ROW is needed because the size of the new line is greater than the existing line.

Advantages and disadvantages of underground electric transmission lines

It is a common practice to place low-voltage distribution lines underground. However, placing high-voltage transmission lines underground is less common and costs two to ten times more than building an overhead line. In addition, while this practice decreases some environmental impacts, it increases others.

Placing transmission lines underground increases the impacts related to soil disturbance and ROW clearing. It disturbs soil all along the ROW, while an overhead line disturbs soil only around the base of poles. Small trees and brush are not allowed to grow on an underground transmission line ROW, but can be

allowed on an overhead line ROW. If the underground line uses an oil-filled pipe (to insulate the conductors), the potential for an oil spill exists.

Placing a transmission line underground decreases the impacts related to the presence or appearance of the power line poles and wires. Sometimes it may also decrease exposure to magnetic fields (because the line conductors are closer together or because the metal pipe helps cancel them, not because the earth blocks them).

Generally, placing a transmission line underground has *greater* impact than an overhead line in rural areas and less impact than an overhead line in urban areas.

Impacts on Resources

This section describes the potential impacts of a new power line on resources, from A (Aesthetics) to W (Wetlands). Possible mitigation methods are noted.

Aesthetics

Aesthetics is how people perceive (view, hear, smell, or touch) resources. Because people's tastes and perceptions differ, aesthetic impacts are difficult to assess. However, some areas are generally considered aesthetically important:

- Natural areas, such as woods and wetlands.
- Recreational areas, such as parks or the Ice Age Trail.
- Historic areas.
- Scenic areas and rivers.
- Scenic roads.

Aesthetic impacts depend on these factors:

- The physical relationship of the viewer and the power line (distance and sight line).
- The activity of the viewer (living in the area, driving through or sightseeing).
- The background, or context, of the power line (does the line stand out or blend in; is the background industrial or natural).
- The potential for mitigating impacts (planting shrubs to block the view; choice of pole material).
- Individual perceptions and values.

Many people consider natural resources and power lines to be incompatible. Joint studies by the University of Wisconsin and the U.S. Forest Service found that, regardless of gender, socio-economic class, or education, our "peak aesthetic experiences" occur more often in natural than human-built settings. The conflict of power lines with cultural resources is less clear-cut.

A power line can affect aesthetics by:

- Removing a resource (clearing fencerows that provide visual relief in a flat landscape).
- Degrading a resource (creating a ROW through a woodland) or degrading the surrounding environment (intruding on a vista).
- Enhancing resource (evoking an image of economic strength in a developing business or industrial area).

Minimization techniques for aesthetic impacts

Utilities can route lines to avoid areas generally considered scenic. They can choose routes where lines are more compatible with land uses, such as commercial/industrial areas or corridors (roads, electric lines, or railways) or along land use boundaries.

ROW management can mitigate aesthetic impacts by planting vegetative screens to block views of the line, leaving the ROW in a natural state at road crossings, creating curved or wavy ROW boundaries, pruning trees to create a feathered effect, avoiding soil erosion, and screening and piling brush from the cleared ROW so that it provides wildlife habitat.

When designing a power line, utilities can modify its form, color, texture, and line. Research has shown that certain structure designs can make a line less obtrusive. The color and construction material of poles can be chosen to blend with or complement the landscape around them. Stronger conductors can minimize power line sag.

Placing a power line underground usually decreases aesthetic impacts by removing the power line from sight. However, some underground lines need obtrusive overhead facilities and visual impacts may increase because in forested areas bushes and small trees would not be allowed to grow on the ROW.

Agriculture

Transmission lines can affect farm operations and increase costs for the farm operator. Potential impacts depend on the power line design and the type of farming. Power lines can affect field operations, irrigation, aerial spraying, wind breaks, and future land development.

Pole placement in farm fields can:

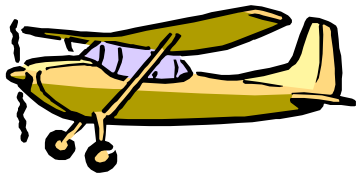
- Create areas that are difficult or impossible to cultivate.
- Create uncropped gaps in row crops that reduce crop yields in adjacent rows due to weed invasion.
- Create problems for maneuvering field machinery and maintaining efficient field work patterns.

If machinery is damaged through collision with poles, the farmer is responsible for damage to both the machinery and the poles.

Power lines can disrupt center pivot irrigation by:

- Blocking the traveling irrigation equipment.
- Shrinking the size of the pivot circle or requiring expensive corner swing arm structures.
- Interfering with well drilling and maintenance. (The State Electrical Code sets clearance requirements.)
- Interfering with guidance systems. (This is due to induced currents. Utilities can correct this problem if it occurs.)

Power lines can hinder aerial spraying or seeding because the lines are generally higher than the altitude flown by crop spraying aircraft. Lines over, and adjacent to, fields can create an obstacle that increases the danger and lowers the effectiveness of aerial spraying and seeding. Guy wires that extend into fields can be especially dangerous because they are difficult for pilots to see.



If windbreaks are removed or significantly trimmed for a new power line, soil erosion can increase and crop yields decrease.

Windbreaks also keep snow on fields and are sometimes required for tax credits.

Power line construction and maintenance can damage crops and farm property. State law requires utilities to repair or pay for this damage. The utility negotiates payment with each landowner.

A power line may restrict future land use since, for instance:

- Its location may complicate or preclude future irrigation.
- Its location may change the size of usable land parcels for future residential or commercial development.
- Trees cannot be grown for timber or pulp on the ROW. (Christmas trees can be grown.)

Minimization techniques for agricultural impacts

Problems with pole placement can be addressed by placing single-pole structures on the edge of road ROW, railroad ROW, or fence lines. If a field must be crossed, larger structures can span fields. If the structure is not single-pole, it should be oriented with the plowing pattern. Guy wires should be placed outside crop or hay land and should have highly visible shield guards.

Utilities rely on local residents and government officials to identify where new or consolidated irrigation systems are planned.

There are several ways to address potential problems with aerial spraying. Markers can be placed on the shield wire, above the conductors. Power lines can be built as low as possible (however, that increases the ROW requirements and number of poles). Informing pilots of line changes is important. New power lines may conform with obstructions already taken into account by pilots if they are located along existing transmission or distribution routes, or road ROWs.

Airports and airstrips

Power lines are a potential hazard to aircraft during takeoff and landing. To ensure safety, local ordinances and Federal Aviation Administration (FAA) guidelines limit the height of objects off the ends and sides of a runway. To meet safety standards, utilities can route power lines outside the safety zone, use special low-profile structures, put a portion of the line underground, or place lights or other attention-getting devices on the conductors.

Archeological sites

Artifacts are the tools, household items, old gardens, burials, and other evidence of people who lived here in the past. Archeological sites are the locations of artifacts, which may be deeply or partially buried in the soil. Archeological sites and artifacts are considered endangered resources. They are important and increasingly rare tools for learning about the past. They may also have religious value. Artifacts are most valuable if found in place, as this helps to date them and understand their use. On-site changes in soil color and texture or stains indicate the location of huts, storage pits, or wall posts.

Power line construction and maintenance can damage sites through excavation, crushing by heavy equipment, uprooting of trees, wind or water erosion, or making sites more accessible to vandals. Impacts can occur wherever soil will be disturbed; at pole locations or wherever heavy equipment is used.

Minimization techniques for impacts to archeological sites

Route changes are seldom necessary when archeological sites are identified. Small changes in pole locations and spans can avoid sites. Minimizing use of heavy equipment in the ROW and using soil erosion control techniques reduce potential impacts.

State Historical Society of Wisconsin role

The State Historical Society of Wisconsin (SHSW) has the primary responsibility for protecting archeological resources. The PSC acts as the SHSW's agent to ensure that damage to known archeological sites is avoided or satisfactorily reduced for construction projects approved by the PSC. If any federal permits are required for the construction project, then the federal agency acts as the SHSW's agent.

The PSC or federal agency requires the utility to search SHSW records for known archeological sites along power line routes. If there are known sites in the area, the SHSW may require a field survey. If archeological sites are found at the proposed location of a power pole, the utility must follow SHSW recommendations to minimize impacts.

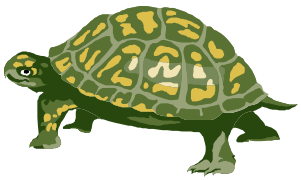
Sometimes the SHSW identifies general areas that have a high likelihood of harboring undiscovered archeological resources. Agreements about what the utilities will do to preserve these resources, if found, are made on a project-by-project basis.

Cultural concerns

When the values of a group or community conflict with a new power line, a cultural concern may exist. Two examples are the Amish, who do not use electricity, and a community committed to the use of renewable energy in the Amherst area. Cultural concerns are not an issue for every transmission project and are difficult to assess when they arise. For example, the Amish often avoid becoming involved with governmental processes and may be reluctant to comment or provide input.

Endangered/threatened species

The existence of "endangered" species is in jeopardy. "Threatened" species are likely to become endangered soon. A problem in number or distribution of "special concern" species is suspected, but not yet proven. There are also natural "communities" which raise special concerns. These communities of plants and animals may be rare because of habitat destruction or because they require unusual soil or other natural conditions.



The Bureau of Endangered Resources (BER) of the Wisconsin DNR uses the Natural Heritage Inventory as the foundation for its preservation efforts. The inventory is based on current and historical surveys of rare plants, animals, and natural communities. The survey information, including the location and status of these resources, is in a computerized database and is available to the utilities and PSC staff.

Construction and maintenance of power lines may destroy individual plants or animals by crushing or digging with heavy equipment. It may alter their habitat so that it is unusable. For example, trees used by rare birds may be cut down or soil erosion may degrade rivers and wetlands that provide habitat.

In some cases, power line ROWs can be managed to provide habitat for endangered/threatened resources. Close cooperation between the utility, ROW maintenance staff, and the BER is needed to develop a management plan. Wisconsin utilities have undertaken to preserve rare prairie habitats in some ROWs.

Minimization techniques for impacts to endangered/threatened species

Some Wisconsin utilities use the Natural Heritage Inventory when planning their projects. This is very effective, as projects which may harm unique natural resources can often be redesigned or relocated.

The Natural Heritage Inventory and BER recommendations are used by the PSC when reviewing specific power line routes. When rare plants or animals are known to be present in a project area, BER may recommend a survey and mitigation measures, such as changing the route or line design, using special construction techniques, or restricting the timing of construction.

Forests

Forests once covered about 66 percent of Wisconsin's land surface. Much of this forested area, especially across the central and southeastern portion of the state, has been cleared for agricultural, urban, and residential development. The number and size of forest tracts continues to decline. With proper management, forest can provide recreation, wildlife habitat, fuel, habitat for rare plants and animals, timber, and pulp.

Building a power line through forest requires that trees and brush be cleared from the ROW. One mile of 100-foot ROW through forest results in the loss of about 12 acres of trees. This loss of forested habitat increases the number of "edge" plants and animals, many of which are common and invasive, and reduces the number of interior (deep) forest species, many of which are rare. Examples of edge species are raccoons, cowbirds, crows, deer, and box elder trees. Deep forest species include some songbirds such as thrushes, wolves, and hemlock trees.

Seeds or other propagative parts of exotic plant species could be brought into a forest inadvertently by construction activities. Disturbance caused by construction could also create conditions that encourage aggressive, invasive growth of these species, whether they are brought in by construction or are already present. Exotic species often have no local natural controls on their growth and reproduction once they are established. They can alter a forest's ecological processes by out-competing native species for sunlight and nutrients, or by altering the habitat or food sources of local wildlife. Examples of exotic species that are problems in some Wisconsin woodlands include buckthorn, honeysuckle, and garlic mustard.

A power line ROW fragments a forest block if it is routed through the block, rather than along the edge of the block. Fragmentation, breaking up large forests into smaller tracts, makes interior forest species more vulnerable to predators, parasites, competition from edge species, and catastrophic events.

Disturbance in the ROW during power line construction or maintenance can contribute to the spread of oak wilt disease. Red oak, black oak, and Northern pine oak are especially susceptible and will often die within one year. The cause of the disease is a fungus which is carried by sap-feeding beetles or spread through common root systems. In the upper Midwest, pruning or removal of oaks should be avoided during late spring and early summer, when the fungus most commonly reproduces.

A cleared ROW can increase access into a forest, which may lead to trespassing and vandalism or improved opportunities for hunting and hiking.

Minimization techniques for impacts to forests

Potential impacts to forest can be minimized by:

- Avoiding routes that fragment major forest blocks.
- Adjusting pole placement and span length to minimize the need for tree removal and trimming along forest edges.
- Allowing tree and shrub species that reach heights of 12 to 15 feet to grow within the ROW.
- Following the Wisconsin DNR guidelines for preventing the spread of oak wilt disease if the forest includes oak trees.

Historic sites

Historic sites are structures or places that represent an important part of our recorded history. Historic artifacts are physical evidence of historic times. These artifacts and sites connect us to our past and are important tools in learning about earlier times. They are most valuable when preserved in place, with the surrounding landscape also preserved. A historic structure's relationship to its setting often aids in understanding its significance.

Structures that are from later or modern times "intrude" on historic sites. Power lines may intrude depending on:

- Whether intrusions from another period of history are already present.
- Whether location of the power line interferes with views of the site, or with important views from the site.

State Historical Society of Wisconsin role

The SHSW's role is the same for historic sites as it is for archeological sites.

Property values

When buying property, people consider many factors, such as schools, community services, scenic beauty, water quality, or distance to work. The relative importance of each of these factors varies among individuals. Likewise, the relative importance of a nearby power line varies.

A power line can either increase or decrease an individual's perception of a property's worth. See Table 5. In addition, some individuals do not notice power lines or care about them.

Table 5 Electric power lines and individual perceptions

Increased worth could result from:	Decreased worth could result from:
Increased access to interior lands due to ROW clearance.	Fear of health effects from electric or magnetic fields.
Extra space and light from ROW opening.	Dislike of the visual effect of the power line.
More distance from neighbors if lot size is larger near power line.	Fear of poor radio or television reception.
Reliable, high-voltage electricity for commerce and industry.	Interference with farm operations or placement of buildings.

Assessing impacts of power lines on property values

Appraisers, utility consultants, and university researchers have studied this issue since the 1950s. Recent studies cover many geographic areas and use a variety of methods. The data are often inconclusive and it is difficult to make general predictions. Individual perceptions depend on many factors which are site-specific.

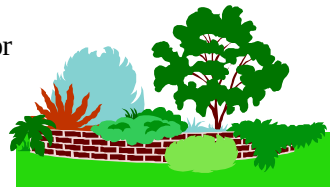
The effects on property values is a factor in utility negotiations with property owners for easement payments. Farm owners are assisted in these negotiations whenever the Department of Agriculture, Trade, and Consumer Protection (DATCP) prepares an Agricultural Impact Statement.

Impacts on property values

Some general points of agreement between studies are:

- Power lines have the potential to reduce the sale price of residential and agricultural property.
- The estimated reduction in sale price for single-family homes has ranged generally from 0 to 15 percent.
- Agricultural values are likely to decrease if the power line poles are in a location that inhibits farm operations.
- Other issues, including size of lot, square footage of a house, and neighborhood characteristics, have a much greater effect on sale prices than the presence of a power line.
- Increases in sale price can occur, particularly where the ROW is attractively landscaped or developed for recreation.
- Effects on sale price have most often been observed for property crossed by or immediately adjacent to a line, but effects have occasionally been observed for properties farther away from a line.
- Effects on sale prices of smaller properties could be greater than effects of sale prices of larger properties.
- Effects on price and value appear to be greatest immediately after a new power line is built or an existing ROW is increased in size. These effects appear to decrease over time.

Recreational areas



Recreation areas are designated places of recreation, such as parks, trails, or lakes. Power lines can affect these areas by:

- Limiting the location of buildings.
- Repelling potential users who focus on the aesthetics of natural surroundings.
- Endangering or changing the type of area wildlife.

These impacts can be minimized by:

- Locating power lines along the edge of properties.
- Providing vegetation screens or using pole designs that blend into the background.
- Developing the power line ROWs for recreation.

Power line ROW's can provide trails for those who snowmobile, ski, bike, hike, or hunt. Development of these trails depends on the landowner and zoning.

River crossings

The type and significance of power line impacts on river crossings vary greatly, depending on each river's characteristics:

- Physical features, such as channel width and water quality.
- River uses, such as commercial or recreational.
- The scenic beauty of the river and its surroundings.

Potential impacts on river crossings

Soil erosion can decrease water quality. Clearance of shade trees and brush can increase water temperature. These changes would affect fish and other aquatic life.

Rivers and shorelines are often migratory corridors for songbirds, waterfowl, and other large water birds. Power lines can interfere with flight patterns resulting in bird/wire strikes.

Minimization techniques for impacts in river environments

Power line impacts in river environments can be minimized by:

- Designing the line to span the river.
- Avoiding placement of poles in or immediately adjacent to the river.
- Using DNR approved erosion control methods
- Placing markers on the top (shield) wire to make the wires more visible to birds if the potential for collisions is high.
- Using bushes to screen the line crossing.
- Maintaining shaded stream areas where possible.

Safety

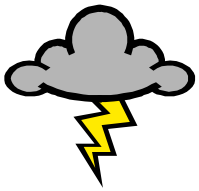
Power lines must meet the requirements of the Wisconsin State Electric Code. This code sets design and operating standards, and sets minimum distances between wires, poles, the ground, and buildings. The PSC ensures that utilities comply with the state code.

People who work around power lines must avoid contact with the energized wires. The height of transmission lines makes this less of a problem than for distribution lines or service drops.

Transmission lines are designed to trip out of service (turnoff) at once, if they fall. (This is not true of distribution lines.) Transmission lines are not likely to fall down, unless hit by a tornado, or a truck.

When a power line is to cross a landfill, toxic waste site, or any potentially contaminated soil, the utilities must exercise care to avoid the spread of contamination during construction. The DNR oversees and sets requirements for any construction in such areas.

Power lines and lightning



Transmission lines are built with a grounded shield wire at the top of the poles. This protects the power line from lightning. Power poles, like trees or other tall objects, may be more likely to intercept nearby lightning strikes, but do not "attract" lightning. Lightning is not more likely to strike houses or cars near a power line. Shorter objects very near or under a line may actually receive some protection from lightning.

Differences between stray voltage, induced currents, and EMF

Stray voltage refers to very small currents traveling through distribution lines and customer wiring. This can be a problem on dairy farms. (See the discussion of stray voltage.)

Induced current refers to a small current traveling through a metal object (such as metal fences or roofs) parallel to and near but not in contact with, a power line. People can receive a shock by touching such an object or by using large equipment, like a tractor, under a power line. The shock is similar to that received by touching a television after walking across a carpet. Induced current is easily prevented or corrected by grounding metal objects located near a power line. (For example, grounding chains can be put on tractors.)

EMF stands for electric and magnetic fields. These fields surround all electric facilities, including home appliances. There is controversy over the effects of magnetic fields on human health. The PSC analyzes EMF levels near proposed transmission lines.

For a more in-depth discussion of this issue, see the Overview "EMF: Magnetic Fields."

Social issues

Social issues are often raised by individuals along proposed power line routes. Two common issues are:

- Users versus payers.
- Freedom of choice versus powerlessness.

People often feel that groups who use the most electricity should bear the impacts of the facilities that are required to meet that use. This is a "fairness" issue and often a "rural/suburban/urban" issue.

The money paid to landowners for ROW easements is meant to compensate them for having a power line on their property. However, some landowners question whether payment can truly compensate for environmental impacts. Also, people who live near the line may be affected although they do not get any easement payments.

The concept that "users should pay" arises from:

- Increasing pressure of competing land uses.
- Repeatedly imposing on one group in society.
- Belief that money cannot cover all the environmental costs that a power line creates.

People want control of their lives. Placing a power line on their property can threaten this sense of control. However, use of electricity in the home has a direct connection with the need for more power lines. This

means that one person's freedom of choice to use electricity could result in another person's feelings of helplessness about having a power line on his or her property.

Stray voltage

Stray voltage is a small voltage between two contact points (generally grounded metal objects). This is a concern on dairy farms because, if a cows touches the two contact points at the same time, it may sense a small current. In some instances, stray voltage can cause a cow to produce less milk.

Stray voltage is not a hazard to people. The utilities, the DATCP, and the PSC have programs to identify and solve stray voltage problems. In nearly all cases, these problems are due to utility distribution lines or the wiring on a farm. These problems are very seldom due to transmission lines.

Wetlands

Wetlands serve several vital functions: storing runoff, regenerating groundwater, filtering sediments and pollutants, and providing habitat for fish and wildlife. Since European settlement, more than half of Wisconsin's wetlands have become agricultural or urban areas and development threatens much of the remaining wetland acreage.

Impacts on wetlands

The construction and maintenance of power lines can damage wetlands in the following ways:

- Heavy machinery can crush wetland vegetation. Destruction of native plants can promote weedy vegetation that fails to provide food and nesting habitat for wildlife.
- Wetland soils, especially very peaty soils, can be easily compacted. Soil compaction increases runoff and greatly reduces water-holding capacity. This impairs or destroys wetland functions.
- If access roads are required, they can change the amount or direction of water flow, causing permanent damage to wetland soils and vegetation.
- Equipment can stir up sediments, endangering fish and other aquatic life.
- Sandhill cranes, waterfowl, and other large water birds can collide with power line wires, especially at dusk or in poor weather.
- Clearing forested wetlands can change the wetland to a shrub community, thus removing habitat for species of the forest interior.
- Construction equipment can carry purple loosestrife, reed canarygrass, or other exotic plant species' seeds or plant parts into a wetland. If there are no natural controls for these species in Wisconsin wetlands, they can invade and take over. Once present, purple loosestrife, for instance, spreads rapidly, crowding out native vegetation and destroying wildlife habitat.

Organic soils consist of layers of decomposed plant material. These soils are formed very slowly. If disturbed by filling, digging, or compaction, wetland soils are not easily repaired. Severe soil disturbance may permanently alter wetland hydrology.

Minimization techniques for impacts to wetlands

Some minimization techniques for impacts to wetlands are:

- Avoid placing power lines through wetlands, especially those that are not adjacent to roads.
- Limit construction to winter months when soil and water are frozen and vegetation is dormant.
- Carefully clean construction equipment after working in areas infested by purple loosestrife or other known invasive, exotic species.
- Span wetlands by using special pole designs.
- Place markers on the top (shield) wire to make the lines more visible to birds if the potential for collisions is high.

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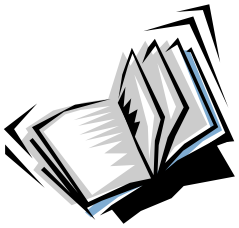
PSC Overview Series

The Public Service Commission has prepared other Overviews for important electric issues. These are:



- Air Quality Issues for Electric Power Generation
- Electric Energy Efficiency
- Electric Transmission Lines
- EMF—Electric and Magnetic Fields
- Merchant Plants and Other Non-Utility Generation
- Nuclear Power Plant Decommissioning and Radioactive Waste Disposal
- Power Plant Siting
- Power Plants
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- Right-of-Way and Easements in Electric Facility Construction
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To obtain any of these Overviews, contact Gail Hanson, by phone (608) 267-2896 or e-mail *hansog@psc.state.wi.us*, at the Public Service Commission or check our home page at : http://www.psc.state.wi.us.

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